tion instead of a simple resistor, because the optocouplers' nonlinear characteristic allows a higher current range without substantially affecting the noise gain of the transimpedance amplifier. The total output noise in the circuit is 80 μV rms. A 6.8-kΩ resistor can reject the same 1.5-mA dc current, but it produces 200-μV output noise. (DI #2364).

V/I converter accommodates grounded load

Michele Frantisek, Brno, Czech Republic

The voltage-to-current (V/I) converter in **Figure 1** uses three common op amps, two medium-power transistors, and only a few passive components. The first op amp (IC_1) inverts the sum of voltages V_{IN} and V_{OUT} to $V_1=-(V_{IN}+V_{OUT})$. The second op amp (IC_2) and transistors Q_1 and Q_2 invert this voltage to produce $V_{IN}+V_{OUT}$. The formula for calculating the output current is thus:

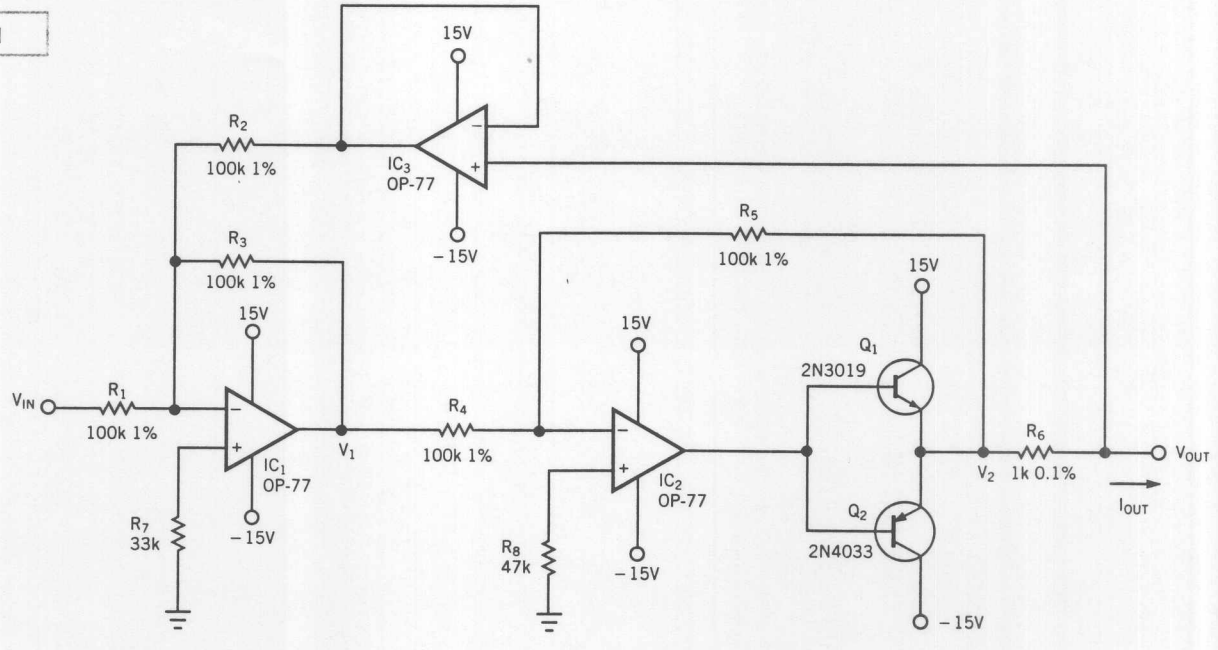
$$I_{OUT}=\frac{V_2-V_{OUT}}{R_6}=$$

$$\frac{V_{IN}+V_{OUT}-V_{OUT}}{R_6}=\frac{V_{IN}}{R_6}.$$

The formula shows that the value of I_{OUT} depends only on V_{IN} and R_6. Voltage follower IC_3 reduces to a negligible level the current from the circuit output to IC_1. The advantages of the circuit are:

- load-grounding possibility;
- simple control of I_{OUT}/V_{IN} ratio;
- high precision, linearity, stability, and bandwidth;
- wide I_{OUT} range, approximately 1 μA to I_C(max) of Q_1 and Q_2; and
- high output resistance of approximately 50 MΩ. (DI #2365).

Figure 1



A versatile voltage-to-current converter provides a handy current source in many analog applications.